Create Your Own Science Planning Tool in 3 Days with SOA

5th International Symposium on Reducing the Cost of Spacecraft Ground Systems and Operations (RCSGSO)
July 8-12, 2003
Pasadena, CA.

Barbara Streiffert, Carol Polanskey and Taifun O'Reilly

Jet Propulsion Laboratory
California Institute of Technology
National Aeronautics and Space Administration
4800 Oak Grove Drive, Pasadena, CA 91109-8099 USA

B Streiffert:
Barbara.Streiffert@jpl.nasa.gov
+1(818)354-8140
Mail Stop 301-250D
Fax: +1 (818) 393-5074

C Polanskey:
Carol.A.Polanskey@jpl.nasa.gov
+1 (818) 393-7874
Mail Stop 301-250D
Fax: +1 (818) 393-5074

T O'Reilly:
Taifun.OReilly@jpl.nasa.gov
+1(818)354-1170
Mail Stop 301-250D
Fax: +1 (818) 393-5074

ABSTRACT

Scientific discovery and advancement of knowledge has been, and continues to be, the goal for space missions at Jet Propulsion Laboratory. Scientists must plan their observations/experiments to get the maximum data return in order to make those discoveries. However, each mission has different science objectives, a different spacecraft and different instrument payloads, as well as, different routes to different destinations with different spacecraft restrictions and characteristics. In the current reduced cost environment, manageable cost for mission planning software is a must.
Science Opportunity Analyzer (SOA), a planning tool for scientists, utilizes a simple approach to reduce cost and promote reusability.

SOA, an object-oriented JAVA based tool that runs on Sun Solaris and PCs, has been built to allow users or projects to customize the software to their mission. The software has two elements—a project specific element and a core element (project-independent). Initially, a project or a user can perform the simple three-day adaptation and use the core functionality. Building the project specific models is done in three steps. The first step consists of obtaining and/or creating JPL navigation SPICE kernels. These kernels consist of planetary constants, spacecraft trajectory, planetary ephemeris, instrument field of view definition, and spacecraft/instrument coordinate frame definition. The development team can help with providing some of these kernels. The second step is to create a configuration file. This file configures SOA to load in the project specific SPICE kernels and constraints as well as other core models. The optional last step is to create project specific geometric constraints (such as exclusion zones) using the SOA flight rule builder, a standard core feature. At this point the 3-Day project adaptation is complete and the user has an SOA that is specific to his/her mission.

Now the user has the ability to perform a set of tasks using the five of the six major functional areas in SOA: Opportunity Search, Visualization, Observation Design, Constraint Checking, and Data Output. Opportunity Search allows scientists to search for interesting geometric opportunities including eclipses, flybys, etc. Visualization shows them a picture at the time of the opportunity or any other time of interest. Observation Design allows them to construct an actual observation at the time of the opportunity using SOA core observation types (i.e., mosaic, scan, roll scan, etc.), and then check for constraints, such as violating how fast the spacecraft can turn, with Constraint Checking. SOA also lets the scientist check various aspects of the design using Data Output to obtain ancillary data. The data can be either plotted or presented in tabular form. This adaptation is sufficient for the early phases of a mission. Later in the mission after project specific spacecraft activities have been defined and the flight software has been built, SOA provides the flexibility to implement a more specialized project adaptation by adding these new elements to the software.

Now anyone can build his/her own sophisticated science-planning tool in a minimal amount of time at an extremely low cost with the Science Opportunity Analyzer.